

On the Ascidiæ collected during the Cruise of the Yacht 'Glimpse,' 1881. By H. C. SORBY, LL.D., F.R.S., and W. A. HERDMAN, D.Sc., F.L.S., Professor of Natural History in University College, Liverpool.

[Read June 1, 1882.]

(PLATES X. & XI.)

THE cruise of the 'Glimpse' round the South coast of England commenced early in May, and ended in October, 1881. Very little dredging was done from the yacht in the open sea. Nearly all was done in water less than 12 fathoms deep, by means of a light but most efficient dredge, 25 inches wide, worked by Dr. Sorby himself from the stern of the gig. With a crew of two rowers there was no difficulty in dragging this dredge, which often brought up as much as could be "docked" and lifted into the boat. A new kind of grapple was also used, especially in the early part of the cruise. By thus dredging from a boat, places could be easily examined where nothing could be done from a yacht. Possibly the successful results are to a great extent due to this cause, since certain objects were more abundant in many of the sheltered places than in the more open sea; and probably some had not been previously explored. Many thousand specimens of Ascidiæ must have been dredged during the cruise. Comparatively few specimens of some of the more common species were preserved; but the individuals of the rarer sorts were retained. All the specimens kept were placed in the hands of Professor Herdman, who has carefully investigated them and given the scientific descriptions, Dr. Sorby confining himself to certain particulars observed when the animals were alive, and to the general manner of their occurrence. Towards the close of the cruise the relation between the different organisms and the general character of the bottom in various localities became more and more apparent; and it therefore seems desirable to give the following particulars:—

*Southampton*: sandy mud, with many dead shells. *Cowes*: sandy mud. *Poole Harbour*: extensive mud banks, with intervening channels several fathoms deep, the bottom of which consisted of dead shells and gravel; it was in these channels that the Ascidiæ were dredged, along with many sponges &c. *Hoole's Bay*: wide expanse of mud and narrow channels with muddy bottom, but not deep anywhere. *Weymouth Bay* and *Portland Roads*: sandy mud and pebbles, with dead shells. *Dartmouth*: coarse and finer shingle, with dead shells; strong tidal current. *Torbay*: some parts clean gravel, and others clean sand, washed by wave-action. *Orwell* and *Stour*: extensive mud banks with relatively deep

channels, having a clear shingly bottom; very many sponges. *Brightlingsea*: sandy mud, with stones and dead shells.

### ASCIDIÆ SIMPLICES.

#### Fam. 1. CLAVELINIDÆ.

##### CLAVELINA LEPADIFORMIS, O. F. Müller.

The only locality where this species was met with was Dartmouth, where a single large colony of well-grown individuals was dredged in July, on a shingle bank inside the harbour near the entrance, off Gunfield, in 2 to 6 fathoms, where the tide runs strong. In the spirit-specimens the lines on the thorax are between cinnamon and straw-colour. The largest individuals are about an inch in length. Most of them had embryos or tailed larvæ in the peribranchial chamber; and one had a specimen of *Modiolaria marmorata* imbedded in the test behind the branchial sac.

#### Fam. 2. ASCIDIIDÆ.

##### CIONA INTESTINALIS, Linn.

This common species was obtained at various localities varying in depth from 2 to 6 fathoms.

At Dartmouth a large number, probably some hundreds, were found sticking to the bottom of the yacht when cleaned on July 26th. They were of various sizes, from an inch downwards.

Dr. Sorby's impression is that the attachment took place at Poole, at the end of May or beginning of June. "It was there that I first collected specimens of this species; and though in previous years we had been at all other places visited this year except Poole, Ascidiæ were absent, or present to so limited an extent that neither myself nor any of the crew noticed them on the bottom of the yacht. If the larvæ attached themselves at Poole, the well-grown individuals must have been about two months old when observed at Dartmouth. They could not have been more than three months old, since the yacht was cleaned before starting from the river Colne in Essex early in May. After visiting Poole we remained four weeks at Weymouth, then a week at Portland, where this species was also found, and afterwards three weeks at Dartmouth before the Ascidiæ were seen. We did nearly the same in 1880 at the same time of the year; and yet none were remarked when the copper was cleaned. On the whole, then, though the evidence is not quite conclusive, all the facts seem to agree with the view expressed above, and that the specimens had grown to the length of an inch in about two

months; but it is just possible that some might be three months old, and some only one."

About a dozen specimens of moderate size were preserved. They are of rather elongated form, perhaps on account of the unusual conditions in which they grew; and the test is thin and transparent. The genital glands are well developed, and the specimens seem sexually mature. When living, some of them had a slight orange tint, while the specimens from Poole and Portland were quite pale.

*ASCIDIA PLEBEIA, Alder.*

A single specimen was dredged off Brightlingsea, Sept. 27th, just west of the beacons outside the harbour, in 2 fathoms. The species was not met with elsewhere; and this locality was only dredged for a few hours. The specimen obtained is of fair size. The test is translucent, and of a light-brownish hue in place of the usual dull green. It is a good deal covered with Hydroids and Polyzoa.

*ASCIDIA ASPERSA, O. F. Müller.*

This common species was found at a number of localities, the depths ranging from 2 to 6 fathoms. The specimens from Poole and Portland are a rather elongated variety, with the test thin and smooth on the outer surface. These, when living, measured up to 2 inches in length. They were larger and less pigmented round the apertures than the ordinary rugose forms.

*ASCIDIA VIRGINEA, O. F. Müller.*

This species was common in the Orwell at Pin Mill in the middle of September, at a depth of 2 or 3 fathoms. When alive the colour varies from orange to green of variable intensity.

*ASCIDIA MAMILLATA, Cuvier.* (Plate X. figs. 1-5.)

Three specimens of this fine species, one very large and one small, were obtained at Portland inside the breakwater during August, in 3 or 4 fathoms. The small specimen, which is remarkably mamillated, was dredged on August 16th from 3 fathoms of water. The largest specimen, when alive, was  $4\frac{1}{2}$  inches long, 3 inches broad, and 2 inches thick. It was of a dull greyish-white colour.

This is a common Mediterranean species; but, so far as we know, it has not previously been found in our seas\*. Probably it

\* Since the above was written Mr. S. O. Ridley has informed us that there are in the British Museum two specimens of a large *Ascidia* collected at Weymouth by Dr. Bowerbank, and which are probably *A. mamillata*. We have not yet had an opportunity of examining these specimens.

does not extend much further north than the Channel. It does not occur in Traustedt's list of the Simple Ascidiæ of the Danish seas\*.

*Ascidia mamillata* has a very characteristic appearance, and is easily recognized. Heller† gave a good general description of the species in 1875; and, more recently, Julin‡ has made it the subject of one of his investigations into the nature of the dorsal tubercle and neural gland. The arrangement of this "hypopharynx" system in the largest specimen is exactly as described by Julin from an adult animal; but in neither of the smaller specimens is there any trace of a dorsal tubercle or terminal aperture into the mouth of the branchial sac (Pl. X. fig. 4). In these specimens there is also no peritubercular area. As noticed by Heller, the anterior part of the dorsal lamina is double for a considerable distance, nearly as far back as the nerve-ganglion which is close to the atrial siphon (Pl. X. fig. 3). The tentacles are of three sizes (Pl. X. fig. 2). In the moderately large specimen there are twenty large tentacles and twenty smaller, and about the same number of very minute ones which alternate with the others, but only occur in some of the spaces (Pl. X. fig. 2, *tn*'). Opposite the end of the dorsal lamina two large tentacles occur close together; and opposite the end of the endostyle seven large and seven smaller are placed alternately, but close, while the minute ones are entirely absent in this region.

### Fam. 3. CYNTHIIDÆ.

#### STYELA GROSSULARIA, *van Beneden*.

This very common species was found in abundance on dead shells at various places in the English Channel. The specimens are all of the squat, blister-like form, and are mostly of small size. They occur attached to dead shells, stones, and the tests of other Ascidiæ.

There are several specimens from Cowes, Southampton, and the Orwell, which belong to a well-marked variety. In shape they differ greatly from the typical form, being elongated antero-posteriorly. The specimen from Cowes is  $\frac{5}{8}$  inch in length and only  $\frac{3}{8}$  in its greatest breadth. The apertures are placed at the extre-

\* "Oversigt over de fra Danmark og dets nordlige Bilande kjendte Ascidiæ Simplicæ," Vidensk. Meddel. Nat. For. Kjøbenhavn, 1880.

† "Untersuchungen über die Tunicaten des Adriatischen Meeres," ii. Abth., Denksch. der k. Akad. der Wissensch. Wien, Bd. xxxiv. 1875.

‡ "Recherches sur l'organisation des Ascidiæ simples," part ii., Archives de Biologie, vol. ii. 1881.

mities of the anterior end. From a consideration of the external appearance only, this form would certainly be referred to a different species from the typical blister-like *Styela grossularia*; but the internal characters are the same in both. The oblong variety shows the peculiarly abnormal branchial sac, with a single well-developed longitudinal fold at the dorsal end of the right side, the other seven being rudimentary and represented merely by one or more rows of narrow meshes formed by an approximation of two or more internal longitudinal bars. In the specimens from Cowes and Southampton the dorsal tubercle is of the ring-like type sometimes found in this species\*.

The specimen from the Orwell has several young individuals of different sizes adhering to the outer surface of the test. These are neither markedly of the typical squat nor of the elongated form.

*STYELA AGGREGATA, O. F. Müller.*

This interesting species was obtained in considerable quantity in July at Dartmouth, just inside the harbour off Gunfield, in 3 or 4 fathoms of water. The specimens were found adhering together in thick-set clusters on pebbles and dead shells. The individuals did not exceed half an inch in length.

Dr. Sorby says in his notes:—"This is a charming and attractive species. When living, the colour is a peculiar orange, of a fine clear tint, deeper on the long wide openings. When in water, alive, and seen in some positions, it looked like a small terra-cotta vase; but did not live long in my aquarium."

This species was first found in British seas by Prof. Edward Forbes at Dartmouth, but in rather deeper water, 12 fathoms. He referred it to the *Ascidia aggregata* of the 'Zoologia Danica,' and described it briefly in his 'British Mollusca,' vol. i. p. 41, giving also a figure. His specimens were considerably larger than ours, but did not differ otherwise. The species has since been more fully described by Kupffer† and Traustedt‡. These northern specimens, if the same species, seem to be much larger than ours, and to have a stronger and more corrugated test. Kupffer, however, remarks upon the variability of the species; consequently the Dartmouth specimens, if adult, may be a small and smooth-skinned variety.

\* Herdman, "On the 'Olfactory Tubercle' as a specific character in Simple Ascidiæ," Proc. Roy. Phys. Soc. Edin. vol. vi. p. 254, 1880-81.

† 'Jahresberichte der Kommission zur Untersuchung der deutschen Meere in Kiel.' Berlin, 1874. VII. Tunicata.

‡ 'Oversigt over de fra Danmark og dets nordlige Bilande kjendte Ascidiæ Simplices,' Kjöbenhavn, 1880, p. 16.

It seems probable that this species reproduces by gemmation, as suggested by Forbes in 1853. The adult individuals give off long branched stolon-like prolongations from the test near the posterior end of the body; and on these (the "root-fibres" of Forbes), which form a matted mass by which the individuals are united together into clumps, are found young specimens of different sizes. Further observations on the living animal in regard to this point are much needed.

*POLYCARPA POMARIA*, Sav. (?).

Three specimens of a small *Polycarpa*, found sticking together by their bases at Brightlingsea, in 2 fathoms, and one specimen found at Portland in 3 fathoms, are referred with some doubt to this apparently very common and polymorphic species, which includes *Cynthia coriacea* of Alder, *Cynthia tuberosa* of Macgillivray, *Polycarpa varians* of Heller, *Styela pomaria* of Traustedt, and, possibly, *Cynthia sulcatula* and *C. granulata* of Alder.

The shape of the Brightlingsea specimens is irregularly ovate and rather depressed. The largest specimen is nearly  $\frac{3}{4}$  inch broad (dorso-ventrally) and  $\frac{1}{2}$  inch wide, while it is only  $2\frac{1}{2}$  to  $\frac{3}{8}$  inch long (antero-posteriorly). The other two specimens are rather smaller, about  $\frac{1}{2}$  inch in the greatest extent. The Portland specimen is rather higher, being  $\frac{5}{8}$  inch dorso-ventrally at the posterior end,  $\frac{1}{2}$  inch antero-posteriorly, and  $\frac{3}{8}$  inch laterally. They are all attached by a large flattened area at the posterior end. The apertures are both placed on the wide anterior end, moderately far apart; they are sessile and inconspicuous in the spirit-specimens. The surface of the test is rough and corrugated, and slightly incrustated here and there with adhering foreign bodies. The colour, after having been kept in spirit, is a dark reddish brown, except the specimen from Portland, which is greyish white.

The test is thick and very tough, and white on section. The mantle is strongly muscular, and is closely united to the inner surface of the test. The branchial sac is elongated dorso-ventrally, and has four folds on each side. There are four or five internal longitudinal bars on each side of a fold, and only two or three in the interspace, where the meshes are transversely elongated, and contain about eight stigmata each; they are occasionally divided by a narrow horizontal membrane. The tentacles are simple, numerous, closely placed, and large and small alternately.

The dorsal tubercle is nearly circular in outline, and has both

horns turned inwards. The genital glands are very numerous and are scattered over the inner surface of the mantle, projecting into the peribranchial space.

The whole peribranchial cavity and the spaces behind the folds of the branchial sac in the specimen from Portland were packed full of tailed larvæ. The specimen was taken in August.

*POLYCARPA COMATA*, Alder. (Plate X. fig. 6.)

This species was found at several places, more especially at Southampton in May, at a depth of 3 fathoms, and at Pin Mill, on the Orwell, in September. Most of the specimens are about  $\frac{1}{2}$  inch in their greatest length.

Kupffer \* described this species fully in 1874.

Fam. 4. MOLGULIDÆ.

*MOLGULA OCCULTA*, Kupffer.

This species was found at Torbay in two different conditions. Most of the specimens had a uniform coating of fine sand; but some from 4 fathoms, off Daddy's Hole Plain, were covered with small stones and fragments of shell.

The characters agree fairly well with Kupffer's description of this species in the 'Jahresberichte,' p. 224, and with Heller's figures of specimens from the Adriatic †.

There are seven folds on each side of the branchial sac, with three or four internal longitudinal bars on each fold, and one in the interspace. The tentacles are moderately branched; there are six large ones, and three or four series of smaller ones placed alternately.

The dorsal tubercle is large, cordate, with both horns turned inwards, and is reversed, the aperture being directed posteriorly, towards the angle of the peritubercular area.

*MOLGULA CÆPIFORMIS*, n. sp. (Plate XI. figs. 1-8.)

This species appears to be undescribed. It was only met with in Hooles Bay, which may be called a shallow muddy salt-water lake  $1\frac{1}{2}$  mile long,  $1\frac{1}{4}$  mile wide, with deeper channels, and a narrow opening at Poole into the main harbour. Two specimens were dredged at the end of May at a depth of 1 fathom; and their resemblance, when living, to small onions was so great as to make the name *cæpiformis*, which we have given it, very appro-

\* 'Jahresberichte der Kommission zur Untersuchung der deutschen Meere in Kiel.' Berlin, 1874. VII. Tunicata.

† "Untersuchungen ü. d. Tunicaten d. Adriat. u. Mittelm. iii. Abth.," Denksch. k. Akad. Wissen. Wien, Bd. xxxvii. p. 267, Taf. vi. figs. 14-15 (1877).

priate. No other Ascidians were found at Hooges Bay; but all parts of it were not sufficiently examined.

The specific description is as follows:—

*External appearance.*—Shape nearly globular (Pl. XI. fig. 1), somewhat compressed laterally, and rather elongated antero-posteriorly, not attached. Anterior end truncated, slightly produced; posterior wide and rounded; dorsal and ventral edges equally convex. Apertures conspicuous, on large mamilliform projections placed at the dorsal and ventral extremities of the anterior end; both are directed anteriorly and are obscurely lobed. Surface even and nearly smooth, being merely slightly roughened in places, and having here and there a few particles of sand and fragments of algæ attached. This is especially the case towards the posterior end. There are no hairs or other processes developed, and there is no incrusting coat. Colour milk-white, with here and there a hyaline bluish tinge. Length (antero-posterior)  $\frac{3}{8}$  inch, breadth (dorso-ventral)  $\frac{5}{8}$  inch, thickness (lateral)  $\frac{1}{2}$  inch.

*Test* thick and cartilaginous, but soft and rather flexible, moderately tough; whitish grey in section; smooth and glistening on the inner surface, with a hyaline blue tinge.

*Mantle* very thin and membranous, not adhering to the test; musculature feeble, chiefly round the posterior end, dorsal and ventral edges, and on the siphons and their immediate neighbourhood (Pl. XI. fig. 2). Siphons long and conical; sphincters not very strong.

*Branchial sac* large, with seven folds on each side; they converge towards the œsophageal aperture; and the seventh pair, next the endostyle, are very slight. Internal longitudinal bars broad and ribbon-like; four on the uppermost surface of each fold, and none in the interspaces (Pl. XI. fig. 4). Transverse vessels not well marked, distant, provided each with a wide horizontal membrane. The meshes, formed by the intersection of these membranes with the internal longitudinal bars, are large and elongated vertically. Stigmata rather irregular, in some places much curved, in others almost straight, on account of the secondary vessels being here and there coiled spirally, while between the spirals, sometimes for considerable distances, they are more or less straight and run longitudinally.

*Endostyle* rather inconspicuous. The hypopharyngeal groove ends cæcally at its anterior extremity, and does not communicate with the right and left peripharyngeal grooves (Pl. XI. fig. 5).

*Dorsal lamina* short and not wide (Pl. XI. fig. 6, *d. l.*); a plain delicate membrane with no teeth or ridges.



*Tentacles* rather small and much branched, very numerous, and of different sizes placed irregularly.

*Dorsal tubercle* rather large, but placed in a small peritubercular area (Pl. XI. fig. 7). Shape broadly cordate, with both horns turned inwards and the aperture directed posteriorly.

*Alimentary canal* on the left side of the branchial sac. Œsophageal aperture rather more than halfway down the dorsal edge. Stomach not very distinct (Pl. XI. fig. 3, *st.*). Intestine long, its loop being turned anteriorly and then dorsally, so as to enclose the left genital mass and bound it anteriorly.

*Genital glands* large, forming transversely elongated yellow masses in the centre of each side (Pl. XI. figs. 2 and 3, *ov.*); left one in the space between the second part of the intestine and the rectum; right one anterior to the renal organ, on the right side of the mantle.

*Renal organ* elongated transversely, not so large as the right genital mass (Pl. XI. fig. 2, *ren.*), containing a number of yellowish-brown, irregularly branched, and nodulated concretions (Pl. XI. fig. 8).

*Locality.* Hoopes Bay; 1 fathom; end of May 1881: 2 specimens. The above description is taken from the larger specimen.

The only compound Ascidians preserved in the collection were a few colonies of *Botryllus schlosseri*, Savigny, and several small colonies of *Leptoclinum albidum*, Milne-Edwards, growing over the outer surface of the test of an *Ascidia*. Both species were from the Orwell, 2-3 fathoms.

## DESCRIPTION OF THE PLATES.

### PLATE X.

Figs. 1-5. *Ascidia mamillata*, Cuv., and details. 1. Animal with the test removed, to show the mantle and the relations of the branchial sac and intestine, natural size. 2. Part of circle of tentacles and papillated zona præbranchialis, highly magnified. 3. Anterior part of dorsal lamina, slightly enlarged. 4. Anterior end of previous figure, more magnified. 5. Optical transverse section of a papilla of the zona præbranchialis.

Fig. 6. *Polycarpa comata*, Alder. Portion of the branchial sac, seen from the inside, magnified.

### PLATE XI.

Figs. 1-8. *Molgula cæpiformis*, n. sp., and details of anatomy. 1. Animal, of the natural size, from the right side. 2. The same, with test removed. 3. The alimentary canal and left genital mass in their natural position, slightly enlarged. 4. Portion of branchial sac, seen from the inside, magnified. 5. Anterior end of endostyle, to show the relations

of the hypopharyngeal and peripharyngeal grooves. 6. The œsophageal aperture &c., magnified. 7. Dorsal tubercle, magnified. 8. Concretions from the renal organ.

*Explanation of the Lettering.*

<i>d. l.</i> , the dorsal lamina.	<i>p. a.</i> , peritubercular area.
<i>d. t.</i> , the dorsal tubercle.	<i>p. p.</i> , peripharyngeal bands.
<i>en.</i> , endostyle.	<i>ren.</i> , renal organ.
<i>h. m.</i> , the horizontal membrane of the branchial sac.	<i>sg.</i> , the stigmata of the branchial sac.
<i>i.</i> , intestine.	<i>st.</i> , stomach.
<i>i. l.</i> , internal longitudinal bar.	<i>tn.</i> , <i>tn.</i> <sup>1</sup> , <i>tn.</i> <sup>2</sup> , tentacles.
<i>n. g.</i> , the nerve-ganglion.	<i>tr.</i> , <i>tr.</i> <sup>1</sup> , <i>tr.</i> <sup>2</sup> , the transverse vessels of the branchial sac.
<i>ov.</i> , the genital glands.	<i>z.</i> , the zona præbranchialis.

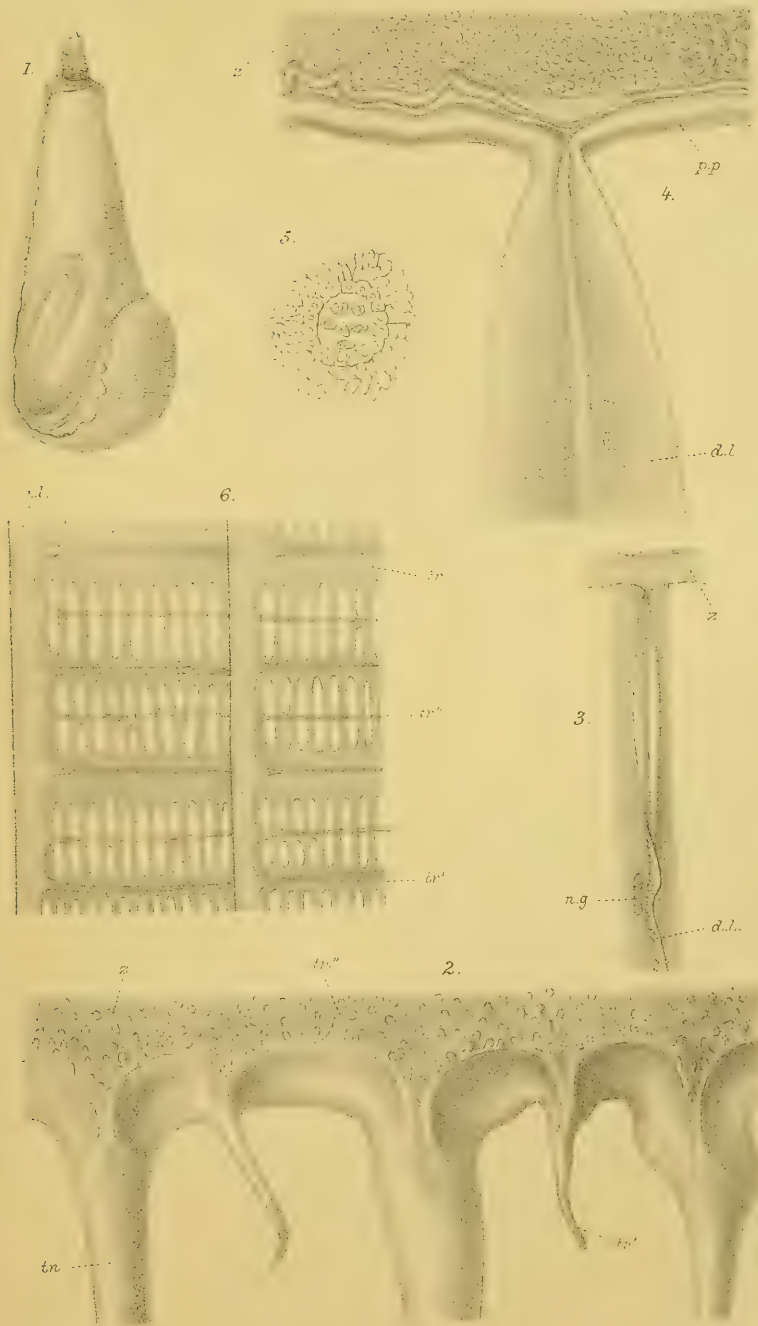
On a probable Case of Parthenogenesis in the House-Spider,  
(*Teigenaria Guyonii*). By F. MAULE CAMPBELL, F.L.S.

[Read June 15, 1882.]

FOR some years past I have confined Spiders with the view of observing their habits. During the autumn of 1878 I imprisoned an adult female *Teigenaria Guyonii*, Guérin (= *T. domestica*, Blackw.), just after her last moult. In the following May she laid eggs, which were hatched; and as her capture had followed so closely on the adult stage, I could scarcely think she had been fecundated, and suspected that the cause of fertility was agamic reproduction.

In the autumn of 1880 I confined three females of the same species as above, having previously satisfied myself as to their immaturity. They moulted successfully at the end of September; but two died during the winter, and the third (May 1881) laid eggs which were non-productive. During the same month the first-mentioned Spider, a few days prior to death, made a cocoon, with the same result. The eggs became shrivelled and hard, while a few retained nearly their original form, but turned green-black in colour. A female (*T. Guyonii*, Guérin) which I had caught adult in December 1880, gave me in July 1881 a large brood. In May 1881 I confined two immature females of the same species. Both cast their skins twice, the last occasion being in September. One died during the winter; and the other has afforded the material for this paper.

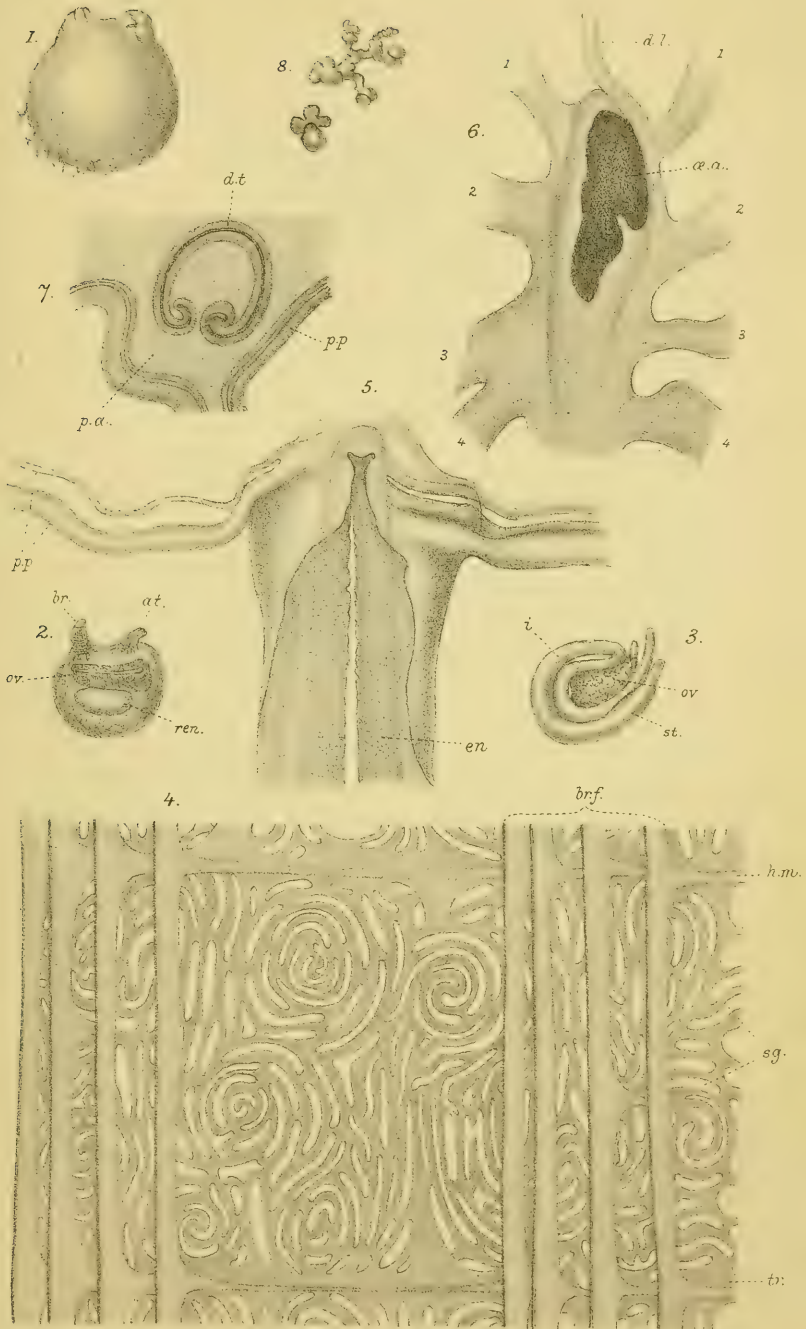
I kept this Spider like the others, each one in a separate flint-glass bottle, 4½ inches high from shoulder to base, and 4 inches in diameter; I covered the mouth with a glass slip. As soon as she became accustomed to her prison, she began to fasten threads,



W.A. Herdman del.

F. Huth, Lith. Edin.

1-5 ASCIDIA MAMILLATA, Cuv.  
6 POLYCARPA COMATA, Alder.



W.A. Herdman del.

F. Nath, Lith. Edin.

MOLGULA CAPIFORMIS. n. sp.